jective coordinates, an account of the parametric representation of twisted cubics and quartics, Staude's elegant thread construction for confocal ellipsoids, and considerable reference to the later results obtained in differential geometry. There are a large number of minor changes, but the numbering of articles and chapters remains unaltered. Mr. Rogers is to be congratulated on the way in which he has executed a far from easy task.

(10) The author claims that the method explained in this volume abbreviates and simplifies very materially the work of surveyors and navigators. It is, of course, impossible for us to judge from a perusal of the book how far the theodolite which Mr. Fergusson has invented is successful in practical work. But Prof. Heath states that it has been tested in the engineering department of Birmingham University, and has proved extremely convenient. He also remarks that

> "the reduction of the results of observations can be carried on simultaneously with the field work without reference to books of tables, thus giving the surveyor full information about any part of the field observed, while he is on the spot. For all traverse surveying, especially for rapid preliminary traverse, subject to modification, the instrument possesses distinct advantages over the ordinary theodolite."

The fundamental idea in the construction of the instrument lies in the method of graduation. To explain the system adopted, we will suppose that OA_0, OA_{100} are two radii of the circle, containing an angle of 45°. Then points $A_1, A_2, \ldots A_r \ldots$ are marked on the rim such that the tangent of the angle A_rOA_0 is equal to $r/100$, where r takes all values from 1 to 100. By this means it is clear that the observer, instead of reading off the angle, obtains its tangent, which is more useful for his purpose. As a matter of fact, the new form of theodolite is also graduated in degrees so that the angle can also be obtained, if desired. The angle A_1OA_0 is taken as unit, and is called the one per cent. angle.

The first fifty pages explain very fully the theory, and numerous examples are given to show its application. The remaining 450 pages are occupied with tables, to the compilation of which the author has given nineteen years. The leading column gives the angle in the percentage form at intervals of 0·001 per cent. below 1 per cent., and of 0·01 per cent. above it. The other columns give logarithmic sines, cosines, tangents, secants with difference tables to seven places of decimals, and the angle in degrees to 0·001 of a second. A shorter table at the end contains tangents of half angles and versines. It seems almost incredible that any one man should have been able to carry through, almost single-handed, such a laborious work as Mr. Fergusson has accomplished. It undoubtedly merits the serious consideration of those engaged in survey work. The bulky size of the volume gives it rather an alarming appearance, but the processes are in reality very simple, and a single hour's work with the instrument would probably be enough to enable any practical man to gauge its utility.

(11) There is a distinct need for a treatise on statics suitable for candidates for entrance scholarships at the universities. A number of excellent introductory text-books exist, but with two possible exceptions we do not know of any work which exactly meets this demand. Many teachers will therefore welcome the publication of Prof. Loney's book, which may be regarded as a companion volume to his "Dynamics of a Particle and of Rigid Bodies," recently issued. It is assumed that the student possesses some knowledge of the methods of the calculus and the elements of analytical solid geometry. In addition to the ordinary elementary course, it contains chapters on shearing stresses, three-dimensional forces, wrenches, chains, attractions and potential, and slightly elastic beams. There is an excellent collection of examples, including some of very considerable difficulty. The author has the rare gift of writing simply, and he has chosen his material with the same skill that characterises his previous work.

PHILOSOPHY AND PSYCHOLOGY.

(1) *Scientific Method: its Philosophy and its Practice.* By F. W. Westaway. Pp. xxi+439. (London: Blackie and Son, Ltd., 1912.) Price 6*s*.

(2) *Proceedings of the Aristotelian Society.* New Series. Vol. xii. Containing the Papers read before the Society during the Thirty-third Session, 1911–1912. Pp. ii+345. (London: Williams and Norgate, 1912.) Price 10*s*. 6*d*. net.

(3) *Anales de Psicologia.* Trabajos del año 1910. Volumen ii. Pp. 360. (Buenos Aires: *La Semana Médica.* Imp. de Obras de E. Spinelli, 1911.)

(1) AN excellent book for science teachers and for the general reader who wishes to acquaint himself with scientific method. Beginning with the consideration of words and the importance of exactness in their use, Mr. Westaway enters on a sketchy history of philosophy, dealing with Plato, Aristotle, Bacon, Descartes, Locke, and Hume. Thence he proceeds to logic,

© 1912 Nature Publishing Group

explaining its function in scientific method, and naturally giving prominence to J. S. Mill, though also quoting Whewell, Bain, Jevons, Alfred Sidgwick, and Welton. Book iii. consists of useful examples of scientific procedure, drawn from the investigations of White of Selborne, A. R. Wallace, Darwin, Harvey, Lord Avebury, and others; while book iv. deals with some elementary principles of science-teaching, and has some very sensible remarks on heuristic methods. The section on Bacon is particularly good, and the famous idols are lucidly explained. Indeed, the whole book is a model of clearness. If it has a fault, it is in the direction of excessive quotation; but this is difficult to avoid when an author is exceptionally well read, and it has the compensating advantage of giving the young student a wide range of actual "samples," some of which may lure him to the study of the authors themselves.

(2) This volume contains papers by Bertrand Russell, Percy Nunn, Boyce Gibson, Dawes Hicks, W. R. Sorley, James Ward, Bernard Bosanquet, and others, on the relations of universals and particulars, animism and the doctrine of energy, the experience of power, the time difficulty in realist theories of perception, and purpose and mechanism. Perhaps the most interesting to the man of science—particularly in view of Prof. Schäfer's British Association address and the various comments thereon—is the symposium on purpose and mechanism. Prof. Sorley, instancing a workman laying the bricks in house-building, points out that the purposive process involves (1) no creation or annihilation of matter, but only rearrangement of masses; (2) no creation or annihilation of energy; (3) no violation of the law of causation; but that it is by no means established that the laws of mechanics are valid also for purposive action; *e.g.*, the laws of motion do not explain the bricklayer. It is "ideal guidance"—guidance by the idea of the house or its parts, existing in the bricklayer's mind—that determines the place of each brick. Purposive action implies certain things which are inconsistent with fundamental principles of mechanics. "Energy is liberated, that is, passes from the potential to the kinetic form, as the result of a purpose, or mental idea, and the same purpose may control the direction of the movement. . . . If purposive action is a reality, then mechanism is an abstract or limited system, and cannot give an adequate account of the real process of things."

Mr. A. D. Lindsay, criticising, remarks that we cannot introduce a non-mechanical into a mechanical system, however much we may insist that it is only a little one; but, at the same time, we can maintain that the mechanical explanation will apply to every part of the human organism, while still holding that this is not a full account of the matter. The discussion was continued by Dr. Bosanquet and Prof. James Ward.

(3) A paper by the late Dr. Ameghino describes fossil remains of two human beings found on the Atlantic coast, 60 kilometres north of Necochea. The skeletons were small, almost pigmy, say about 1·40 metres, and of small build as to strength; skulls small, and decidedly dolichocephalic: frontal part small, face prognathous. Other articles discuss intellectualism and pragmatism, the psychology of criminals, and multiple personality.

J. A. H.

GENERAL AND ECONOMIC GEOLOGY.

(1) *Earth Features and their Meaning*. An Introduction to Geology for the Student and the General Reader. By Prof. W. H. Hobbs. Pp. xxxix+506. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1912.) Price 12*s*. 6*d*. net.

(2) *A Geological Excursion Handbook for the Bristol District*. By Prof. S. H. Reynolds. With an Introduction by Prof. C. Lloyd Morgan, F.R.S. Pp. 224. (Bristol: J. W. Arrowsmith, Ltd.; London: Simpkin, Marshall and Co., Ltd., 1912.) Price 3*s*. 6*d*. net.

(3) *An Introduction to British Clays, Shales, and Sands*. By A. B. Searle. Pp. xi+451. (London: C. Griffin and Co., Ltd., 1912.) Price 7*s*. 6*d*. net.

(4) *Graphical Solution of Fault Problems*. By C. F. Tolman, jun. Pp. 43. (San Francisco: Mining and Scientific Press; London: Mining Magazine, 1911.) Price 4*s*. 6*d*. net.

(5) *Observations on the West of England Mining Region*. Being an Account of the Mineral Deposits and Economic Geology of the Region, and forming Vol. xiv. of the Transactions of the Royal Geological Society of Cornwall. By J. H. Collins. Pp. xxiv+683+18 plates. (Plymouth: Wm. Brendon and Son, Ltd., 1912.)

(6) *Types of Ore Deposits*. Edited by H. Foster Bain. Pp. 378. (San Francisco: Mining and Scientific Press; London: Mining Magazine, 1911.) Price 8*s*. 6*d*. net.

(1) PROF. HOBBS describes his new volume as "a series of readings," the substance of a course of lectures in expanded form. The title concisely expresses the character and scope of the work. The author discusses the figure of the earth, and lays stress upon the tetrahedral hypothesis. He touches lightly on rocks and their mode of formation; deals with earth movements, volcanic action, weathering, and the activities of

© 1912 Nature Publishing Group